UNDERSTANDING INNOVATION:CLASSIFYING TECHNOLOGY USAGE FOR REAL INTEGRATION AND VALUE

By

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ABSTRACT

Educators, calling for quality and effective use of technology, lack distinction more often illustrating the problem than their ideals. Technology educators demonstrate, in an anecdotal fashion, applications calling for replication to follow their lead. But, there's no real understanding of where uses fail nor how to distinguish benefits for students. We must recognize (not tools and applications) but the real distinction from our past. All technology advantages are summarized in four categories: (a) information access, (b) production, (c) sharing, and (d) interactivity control. A case is made for evaluating the value of technology use through these categories.

Keywords: Technology, Teacher education, Integration, Student-centered teaching, Technology benefits, Pedagogy

INTRODUCTION

There is an omnipresent call for finding ways in which computers can represent advancement from the traditional methods of the past as compared to just using technology with the same old methods (Swaminathan & Yelland, 2003; Zhong & Shen, 2002). That is, trend setters and so-called leaders of technology integration and instructional development actively call for change and application in order to realize real value and innovation. The term technology is meant to refer both to the hardware, physical and tangible world as well as the software, electronics and abstract realm of computerization. How might one recognize real innovation, real change and improvement? Do the methods employed by the so-called leaders and shakers of educational change really emulate that for which they call? It is suggested here that a serious lack of understanding exists among educators as to what modern technology really provides and how to achieve it. It is further suggested that the educational technology users themselves fail to understand how to call for the change they seek. Ironic though it may be, it is the educators who do not understand what it means to learn to use technology.

This paper intends to examine and discuss these and related issues to provide some clarity about technology education and usage and how to understand the real value of this modern advantage over our traditional past. Furthermore, this paper prescribes the criteria and methodology for considering the value of technology usage in educational settings.

Background

Educators, as leaders of technological advancement, do call for successful integration and advancement in the usage of technology for real improvements in learning (Smeets, 2005). Demonstrations, presentations, workshops and more are fashioned to call for real and actual improvements in classrooms and learning and not just a repeat of an impotent, superficial and traditional past (Flynn, Concannon, & Bheachain, 2005). But, then, the bells and whistles of various technologies that impress everyone with the latest steps into the virtual world of electronics seem to rule the day. This is accompanied by oratory that promotes one cliché after another as presenters offer their brand of truism, maxim, and general platitude as if such things represent any real understanding.

For example, promoters of technology integration (Clifford, 2001; Linser & Ip, 2002) still present basic principles such as *Do not use technology for technology-sake. Instead, it must be 'student-centered' and pedagogically driven.* But, the presenter does little to

provide examples of what a *technology-sake* scenario might really be. Just where is it that teachers are using smart boards as toys for self-gratification with no thought for presenting to their students? How is it that the Internet is used by teachers in the classroom with no application to or value for students' learning and development toward maturity and competence in their quickly advancing technological future? In other words, does using technology just for *technology-sake* actually occur anywhere and, if so, what exactly does that look like?

For most, such principles are a given. It's obvious to educators that the technology should be devoted to supporting educational goals all of which, in turn, support and facilitate learning goals. This is axiomatic and does not need continual reiteration after 35 years of a technological presence in education. This is much like advising folks not to poke themselves in the eye with a sharp stick. That is, it seems reasonable to assume that teachers are or at least should be in pursuit of educational value and educationally positive experiences regardless of the tools used. The problem of realizing real progress, success and advantage should be defined differently. The issue is not whether such a thing is or is not a worthy principle but how one can tell the difference and how one can facilitate the innovation and value. It is not sufficient to merely recite the obvious and offer the rhetoric of clichés.

Most typically, presenters demonstrate tools and how to use them. When it comes to how teaching methodologies can truly represent innovation and change, presenters offer testimonial and anecdotal evidence of their uses in the classroom. That is, novices are presented with sample uses. This teacher did this; that teacher did that, etc. One can do this or one can do that with various technologies. What's lacking in this is any philosophical framework, theoretical structure and meaningful prescription for developing advanced technology application (Koszalka, Grabowski, & mcCarthy, 2000; Tettegah & Hunter, 2006). This may account for why so many examples of technology usage fall short of real originality and improvement, in spite of the seemingly progressive rhetoric shared among the entire instructional technology community (Cates, Bishop, & Hung, 2000).

To answer this void, so-called leaders try to address guiding principles by calling for creativity, imagination and inspiration in making use of real technology advantages. Of course, they most often make this call in a PowerPoint presentation build exclusively with text on plain or template screens not unlike a 1939 chalkboard. So, what is the alternative? What are the really innovative uses and progressive values to be had with technology in education?

Training and Education

Concerns for the distinction between education and training is not new (Ur, 1996) with some emphasizing the importance and necessity of conceptual development and understanding over procedural rituals and task-oriented skills and competencies (Galloway & Bright, 1988; Galloway, 1992; Siegal & Surian, 2004). The timely nature of technological advancement, the lack of transfer of learning from one task to the next absent a sufficient underlying conceptual base, the demands of real problem-solving and critical thinking with technology, the demand for adaptability and independent advancement with new technologies all require a broader and a more fully developed understanding of technology - as compared to an endless series of discrete workshops focused on training for any particular tasks or procedures. Mere training, per se, usually imparted through isolated and brief workshops, is grossly insufficient not in quantity and scale, but in its limited essence.

Clearly, it is becoming more commonplace for technology to impact both our personal and professional environments as a way of life over the selective, occasional and intermittent application of technology tools (Galloway, 1999; Kittell, 2009). That is, technology is a way of life in which one seeks to live, work and play in a technological environment. This is necessary to solve problems of every sort through or with the support of technological means. Contrast this with a non-technological life-style in which one sporadically seeks a specific technology tool for a specific application without

a sufficient infrastructure of momentum and support in access to and skill with technology. A full commitment to becoming a technology-using-person is a necessary prerequisite to effective utilization of technology in any context. I.e., one cannot expect a non-technology-using person to effectively integrate technology into any aspect of life. Conversely, for fully committed technology-using people of reasonable experience, they have already embarked on a self-education and self-actualization process of integrating technology.

So often, training for teachers in instructional technology involves little more than demonstration and consideration of the uses of technology, which is limited by design to just that: a discrete set of uses. They are shown to passive audiences across the country in every corner of education. The prescriptive stories of one case or another are told and retold like fables of old. These anecdotes and prescriptions have been shared between educators at all levels for the past 35 years. The point of all this training seems to be that if one can replicate those uses then one will be a well-developed technology user. Ediger (2002) also blames insufficient and inadequate training as a basis for technology integration failure, along with the usual elements of access, funding and support personnel.

It brings to mind an analogy of being a great chef. If I can get the recipes and follow them in my own kitchen then I too will be a great chef. The essence of what it is to be a great chef can never, of course, be captured in the mere replication of the chef's recipes, however complete and comprehensive they may be. Becoming anything of substance is most commonly a challenge of achieving a whole that is inevitably greater than the sum of its parts. These two areas of concern are not irrelevant issues in the current discussion of identifying and understanding real innovation and distinction in using technology for modern advantages. So, what does today's technology provide that distinguishes it so greatly from traditional tools and methods of the past? How might one identify and evaluate technology usage as distinct from the traditional past?

Classes of Technology Distinction

It is suggested here (Figure 1) that virtually all modern technology usage falls into one or more of these four categories. Herein is the essential difference from the past. It is in the nature of these four areas that traditional methods lack the advantages provided by modern technology:

1. Access to Information and Experience

For most, the first thought might be of the Internet and all that it provides. Certainly, this is a prime example of information access that is quite unlike the pre-Internet revolution. One might argue that information services through libraries, print news media and more provided a full and complete range of information. But, of course, the ease of access, the speed and the range of material provided through the Internet is certainly different and provides many new opportunities not available before.

Technology also provides retention and retrieval capabilities never seen before. This includes size and space savings, speed of access, variation of formats, personal control and more, all of which are quite advanced compared to non-technology methods. Storage and retrieval is not necessarily pedagogical but managerial in nature. These four categories of technology usage or roles should not be considered mutually exclusive but are summarized as a class or type of usage and benefit that distinguishes technology from our more traditional past. It is suggested that virtually all

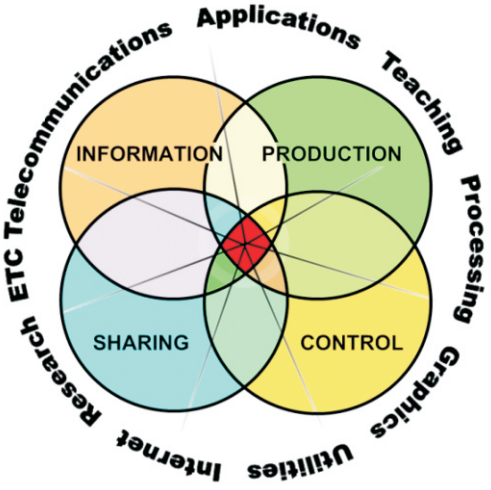

Figure 1. Illustration of 4 classes or areas of technology interaction.

benefits of modern computer usage can effectively be summarized in terms of these four.

Thus, information management and the ease of access and experience distinguish computer technology from all other systems. The computer has become and serves as a real extension of both our short-term and long-term memory. The ease and speed of computerized access to both information and experience is unlike a mere file cabinet for paper and is beginning to truly expand our environment into the virtual and abstract realm of existence. The human mind now has a viable prosthetic to enhance virtually every aspect of our daily lives, however crude the current edition, limited by present progress.

The Internet is a virtually endless source of ideas and information. Of course, material ranges from the crazy, trivial or casual to the serious and important and the consumer must exercise considerable skepticism. Still, with basic search skills one can find answers to almost any question and information to help solve almost any problem. Thousands, if not millions of Forums offer all sorts information on very specific issues (Afterdawn, 2010; DvCreators, 2010; PC Magazine, 2010). Of course, many discussion boards and forums are open and uncontrolled and technical information posted by the public can deteriorate into crude, inappropriate banter.

It must be emphasized that these benefits, like most all such advantages with technology, require a sufficient infrastructure of support, experience, material resources and even personal habit and acclimation. However, this is true of most systemic phenomena. For example, cars require roads. Television requires actors and writers and an audience who seek that entertainment. Even grocery stores require deliveries and consumers who don't grow their own food. Et cetera. Many novices erroneously believe, or perhaps hope, that technological benefits can be had cheaply that is, without paying the price of commitment, labor and cost to develop and maintain the necessary infrastructure. Therein lies the appeal of quick training for tasks over education for critical thinking and real knowledge.

Searching the Internet, saving documents, email exchange, listening to MP3 files and more, are all examples of this category. While educators must be aware of and distinguish managerial from pedagogical applications, the utilization of technology can discriminate from the traditional past by emphasizing the benefits of information access and experience.

2. Production and Publishing

It was once written that the computer is like a tool (Peelle, 1984; Beaty & Tucker, 1987). The analogy suggests the utility value of the technology but limits a real understanding of its potential or its role in our lives. For example, if the computer is like a hammer, then what if one has no need to install a nail? If the computer is like a saw then what if one has no need to divide a wooden board? In other words, the analogy suggests that a computer is tool to be selected or not, if and when the need might arise, depending on specific goals involved. It might be more realistic and certainly more forward-looking to suggest that the computer is not a tool at all but instead an environment. It is a place a kind of fully developed world in which we live, work and play. It is where we relax, communicate, become enriched, interact, explore, get entertained, and more.

One aspect of that world is production. So, the computer is a factory and distribution center. Publishing is like sharing (category III below) but is meant to be distinguished here as reaching an unknown, general or broad audience. We produce products much like a factory with the input of resources and materials, the application of tools and utilities and the generation of new things. These might be documents, images, schedules, functional components, new tools and utilities, compilations of information, files and experiences of all sorts.

The products might be for personal goals or for the broader use by and availability to the world as a whole. The publication of our products making them available and accessible to the world allows even 5 year olds to produce virtually permanent work for other 5 year olds to see and experience around the world in mere seconds. It makes little difference whether the products are considered end-goals finalized for real placement or

representative, hypothetical and merely demonstrative products.

The Internet offers an obvious platform for self-publishing. While this article is published in a prestigious journal, it might just as well have been placed on an Internet Web server and made available to the whole world to read. What used to be done by journalists writing newspaper columns or by contributing editors to magazines and journals, can now be done by any individual writing their own discussion board, forum or blog. Indeed, the internet has millions, some providing critically important and helpful information (Costa, 2010; Dvorak, 2010; Harrington, 2010; Levy, 2010; Segan, 2010) while others spew controversy and propaganda (Curezone, 2009).

Some systems are dedicated to supporting online course delivery and have become critical tools in education. These help expand classroom experiences providing a medium for information exchange, reflection, discussion and more (Carr, 2007; Ducate & Lomicka, 2008; Wang & Hsua, 2008; Yang, 2009).

The Internet provides access to anything by almost anyone and publishing is a natural extension of production. So, at least an aspect of the computer is like a tool, but the technology reaches far beyond such a limited scope. Glue, scissors, paper, nails, boards and typewriters of yesterday, certainly all provided the means for production by students and teachers. But, it is easy to examine usage by educators and students alike to see the distinctive value of modern technology in comparison to our traditional past.

3. Sharing

This intended as an experiential characteristic involving interactivity between people. Sharing is like publishing (category II above) but is meant to refer to the specific exchange among two or members of a group. Certainly, email facilitates the exchange and sharing of information. This is a good example of a technology with unique attributes of information access and sharing, both of which can easily distinguish modern experiences from our traditional past. Even the telephone that allows for almost instantaneous communication in real time is almost as old as the Pony Express. Email can certainly be used in a fashion that is similar in benefit and value to mailing a post card in 1965. But, of course, the potential is much greater.

As mentioned above, the computing world with the Internet is an environment, and for many, it is a social environment. Some own and operate their own domain name and personal web sites but a number of services provide automated features for those who want quick and easy tools for posting pictures, comments, audio and video clips and more. Some include chat-room and instant messaging tools for real-time discussion. Consequently, online socializing and sharing of personal lives becomes a preoccupation and fulltime endeavor for a whole generation. While Baird and Fisher (2006) discuss this phenomenon as helping young people to develop learning styles that are more intense and constantly attentive, there is also a down side. Mark Bauerlein (2008) has described, in considerable detail, the downfall of American youth attributing a tragic ignorance to their exclusive involvement with personal technologies (instead of more traditional reading of books and non-technological endeavors). In particular, he points to the "me-generation" as preoccupied with self, the sharing of self and the inane and self-indulgent exchange of personal trivia. He indicts the generation as ignorant for exchanging knowledge of life, history and relevant issues for the superficiality of entertainment and personal minutia. He primarily blames socialization through technology as the cause.

Certainly, Bauerlein has a point as personal data assistants (PDA's) or multi-function cellular phones are in the hands of virtually everyone. Communities are passing laws to regulate if not prohibit such tools in school zones traffic. Kids are online (On Guard Online, 2010) and connected through personal phone technologies even during class time. While such devices can be very useful for emergencies, there is a natural concern for students using such tools for cheating on tests (Moran, 2008). However, schools have found some value and convenience in texting important messages and updates directly to the whole student body (Davidson & Stone, 2009; Kessler,

2009) using this medium already in the hands of the students. Drouin and Davis (2009) looked at the negative consequences of texting on the literacy of college students experienced with texting. With a control group familiar but unskilled with so-called text-speak, the study showed no relationship to reduced literacy performance with standard English.

One might argue, of course, that all technologies throughout history have both good and bad potential. This duality has never been more poignant than with today's computer technologies. Combining the speed of exchange with distance, repetition, attachments and enhancements reveals the modern advantages. The related technologies of video phone, chat room, instant messaging, automated distribution and more can clearly distinguish the opportunities of sharing and interaction between people from interactivity that is not facilitated by technology. Individuals can participate and contribute to virtual group activities in a practical manner over great distances that make the distance and time factors irrelevant. Simply receiving information is better classified in type 1 above, but the full interactivity between people can be unique in this age of technology.

4. Interactivity

Sharing, of course, involves the interactivity between people, but this type of element addresses the interactivity with the environment itself. One must recognize that people interact with their automobiles, washing machines, tractors and lawn mowers. But, through gaming, simulations and more, and with environment configuration and manipulation capabilities, the computerized environments can interact with us.

We have a personal control over the nature of our environment and the experiences we have. Customized desktops, PDA's, personal libraries, countless services provided online to enhance virtually any technology experience, all emphasize and exemplify personal control.

Keyboards and mice are giving way to virtual keyboards and voice interfaces. We have wireless controls, prosthetic interfaces and more that directly impact the fundamental nature of how we interact with the world. A captive and passive audience watching a text-based PowerPoint and listening to a speaker explain about this or that might be very much like those observing a chalk board in 1939. Limited to this scope, the technology is not making a difference in any of these four categories for the audience. But, it wouldn't take much to step into one or all of these roles and provide significantly more to the target population. The aspect of interactivity alone can make a real difference from our traditional past.

Considering Use and Application

Instead of evaluating whether or not one is using technology for a pedagogically-driven experience as compared to just for the sake of the technology (whatever that might mean), consider usage on the above four categories. A PowerPoint presentation, for example, might provide text on the screen. That text might appear with bullets or underlines or other insignificant markings that fail to really distinguish it from text handwritten on an old chalkboard. So, how is that realizing any modern advantage? Certainly, such a product the PowerPoint slide show presentation can be saved and stored for convenience and retrieved for later use but this is not a facility that impacts the nature of the learning that occurs from using the presentation.

The issue of significance is a key element in considering educational value. For example, while text in the PowerPoint slide show might have small graphic "bullets" helping to delineate and present the text in a visually effective manner compared to a more mundane or simplistic presentation of writing on a blackboard, one must judge whether or not such embellishments have any significant or fundamental impact on the nature of learning that occurs. One must consider what the real difference is and whether such things are incidental or essential, irrelevant or necessary. Animation and effects in a PowerPoint show can seriously differentiate from traditional blackboards, but again, considerations of role and value are necessary. Certainly, this is a judgment call to be made in one's own value system as objectively as possible but the classification scheme provides a

framework in which to make such judgments.

One might, then, consider the four categories of use and value as a kind of check list against which one can evaluate the educational value of technology usage. Figure 2 represents, if not an actual tool for practical use, then at least the conceptual basis for considering the effects of using technology. The question addressed is whether or not using the technology makes any real difference in comparison with our traditional past.

Note that one might score production value as a 3 fine-tuning one's evaluation of that area. Also, note that a score of zero seems appropriate where technology makes no substantive difference. That is, one might just as well have used non-technology means.

Consider, then, how one might score the creation of a typical PowerPoint slide show (Figure 3).

This hypothetical case shows that a teacher perhaps brought many aspects of information and technical experience bear on the planning, development and production of the show, including, perhaps, custom elements, links, etc., and more. One might choose to evaluate the product, the experience, the use and role of technology in that endeavor as worth 14 points compared to what would have been possible in a non-technology-assisted world.

However, as Figure 4, illustrates, the value and role of technology for the student viewer might be quite different. Perhaps the student gets no value from the production capabilities of the computer. Perhaps the presentation provides convenient and efficient links to information but they are not able to interact with others in any significant manner. Also, a passive audience might also not be able to interact with the technology in any significant manner.

Evaluate Technology Value					
☐ For Student ☐ For Teacher		Same Exp. As Non-Tech.	Basic Modern Features	Highly Innovative Progressive	SCORE
I.	Access to Information & Experience	0	2	4	
II.	Production and Publishing	0	2	4	
III.	Sharing	0	2	4	
IV.	Interactivity	0	2	4	
				Total Score:	

Figure 2. Illustration of considering technology value for a particular application.

Evaluate Technology Value					
☐ For Student ☒ For Teacher		Same Exp. As Non-Tech.	Basic Modern Features	Highly Innovative Progressive	SCORE
I.	Access to Information & Experience	0	2	4	3
II.	Production and Publishing	0	2	4	4
III.	Sharing	0	2	4	3
IV.	Interactivity	0	2	4	4
				Total Score:	14

Figure 3. Illustration of scoring a hypothetical PowerPoint slide show by a teacher.

Evaluate Technology Value					
☒ For Student ☐ For Teacher		Same Exp. As Non-Tech.	Basic Modern Features	Highly Innovative Progressive	SCORE
I.	Access to Information & Experience	0	2	4	3
II.	Production and Publishing	0	2	4	0
III.	Sharing	0	2	4	1
IV.	Interactivity	0	2	4	2
				Total Score:	6

Figure 4. Illustration of scoring a hypothetical PowerPoint slide show for a student.

Again, while these tables might not be desired by everyone as tools for conducting such an evaluation, they do represent the concept and focus of consideration for considering the effects of using technology in the classroom. That is, consider how students' experiences are truly improved and enhanced.

Conclusion and Discussion

Overall, then, a student's experience and value realized due to the application of a modern and progressive technology might be weak in contrast to traditional methods of the past. This hypothetical case might be too limited considering that the specifics of the PowerPoint slide in question or the students to whom it would be presented are not available to examine. But, the point is to make a determination, a judgment in considering the real value of technology use (Allen, 2006; Mallery, 2008) and these four classes or categories of technology distinction can help educators make that judgment.

It makes little difference whether the technology is a PowerPoint slide show or an Internet web site or the tools to record and publish audio discs. The point is the same. It is important to identify and understand what it is that is really different when technology successfully reaches its potential. Platitudes and clichés are non-prescriptive and useless for educators already intent on integrating and being effective with technology. It is not a matter of what principle should apply but how one's methodology can

actually achieve such goals.

Certainly, many might reasonably endorse the traditional techniques of the past. After all, what is really wrong with writing text on a chalkboard? All such methodologies have their place, including the long maligned and criticized lecture. But, where the goal is to maximize the role and value of technology, regardless of the tool, the format or the application, it is important to be able to recognize what failure looks like.

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